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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DARYL J. MARVIN and STEVEN M. MILLETT

Appeal 2016-002847
Application 13/808,920[1]
Technology Center 2800

Before ADRIENE LEPIANE HANLON, CATHERINE Q. TIMM, and JAMES C. HOUSEL, *Administrative Patent Judges*.

PER CURIAM

DECISION ON APPEAL

A. STATEMENT OF THE CASE

Appellants filed an appeal under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 1–15.[2] We have jurisdiction under 35 U.S.C. § 6(b).[3]

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[1] According to Appellants, the real party in interest is Otis Elevator Company, a business unit of United Technologies. Appeal Br. 1.

[2] Claims 16 and 17 have been withdrawn from consideration. *See* Office Action Summary of the Final Office Action mailed Mar. 13, 2015 (Final Act.).

[3] Our Decision refers to the Appellants' Specification filed Jan. 8, 2013 (Spec.), the Appeal Brief filed Aug. 10, 2015 (Appeal Br.), the Examiner's Answer mailed Nov. 6, 2015 (Ans.), and the Reply Brief filed Jan. 5, 2016 (Reply Br.).

We REVERSE.

The subject matter on appeal relates to power supplies and methods of controlling a power supply (*see, e.g.*, claims 1 and 11). Appellants disclose that bootstrap power supplies are known and used in consumer electronic devices. According to Appellants, typical gate driver integrated circuits are designed to function with a bootstrap supply. Spec. ¶ 1. Appellants' Figure 1, which is reproduced below depicts a prior art bootstrap power supply.

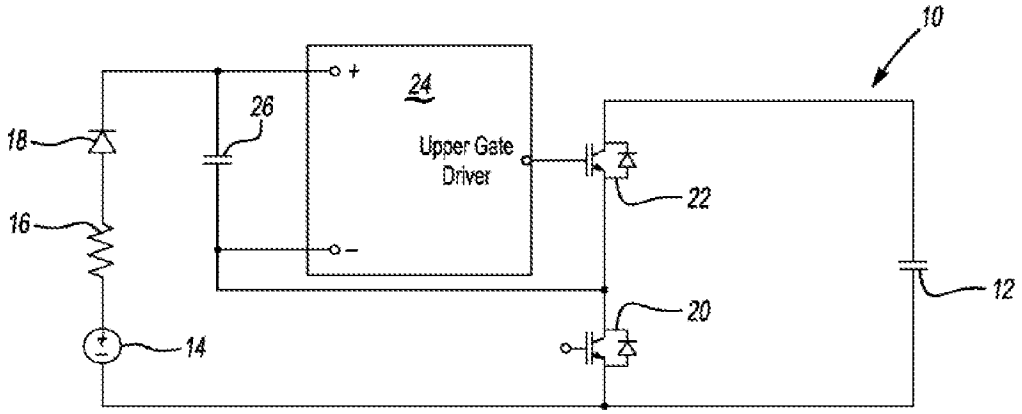

Fig-1
PRIOR ART

Figure 1 depicts a prior art bootstrap power supply arrangement

A prior art bootstrap power supply arrangement 10 includes a voltage source 14 for providing power to a load 12. *Id.* ¶ 2. A limiting resistor 16 and rectifier 18 are associated with the voltage source 14. *Id.* Appellants state a low side insulated gate bipolar transistor (IGBT) 20 "switches on and off in a known manner," "[a] high side IGBT 22 is controlled by an upper gate driver 24," and "[a] bootstrap capacitor 26 powers the upper gate driver 24." *Id.*

When the low side IGBT 20 is conducting, the voltage source 14 charges the bootstrap capacitor 26. *Id.* ¶ 3. When the low side IGBT 20 is off, the bootstrap capacitor 26 is in a floating condition. *Id.* In this state, a voltage drop across the low side IGBT 20 effectively changes the voltage used to charge the bootstrap capacitor 26. *Id.* This causes the power supply for the upper gate driver 24 to be unregulated, which is undesirable. *Id.* Moreover, when high voltages are used, the voltage drop across the low side IGBT 20 is significant in comparison to the voltage source 14, which causes a large variation in the charging voltage for the bootstrap capacitor 26 and difficulty in controlling the voltage for the upper gate driver 24 within a desired range. *Id.* ¶ 4. In addition, the large voltage variation has a negative effect upon the switching performance of the low side IGBT 20 and the high side IGBT 22 and the rate for charging the bootstrap capacitor 26 is relatively slow. *Id.* ¶¶ 4, 5.

In view of the above, Appellants disclose a power supply that includes, among other things, an energy storage portion in parallel with a bootstrap capacitor and a voltage regulator in parallel with the bootstrap capacitor. *Id.* ¶¶ 13, 16. Appellants state the energy storage portion adds voltage to prevent the voltage of the bootstrap capacitor from dropping until a voltage of the energy storage portion drops below the voltage of the bootstrap capacitor, thus providing some control over whether the voltage of the bootstrap capacitor drops. *Id.* ¶ 16. The energy storage portion also promotes a faster, more effective charging of the bootstrap capacitor. *Id.* ¶ 17. The voltage regulator regulates the voltage of the bootstrap capacitor and limits current to the bootstrap capacitor. *Id.* ¶ 18. Overall, the energy storage portion and the voltage regulator dampen effects of a voltage drop

associated with a low side switch being off, protect the bootstrap capacitor from experiencing a rapid increase in voltage, and facilitate charging the bootstrap capacitor more rapidly. *Id.* ¶ 19.

Independent claim 1 is illustrative and is reproduced below from the Claims Appendix of the Appeal Brief.[4] The limitations at issue are italicized.

> 1. A power supply, comprising:
> a low side switch;
> a high side switch;
> a driver that controls operation of the high side switch;
> a bootstrap capacitor that supplies power to the driver;
> *an energy storage portion in parallel with the bootstrap capacitor*; and
> *a voltage regulator in parallel with the bootstrap capacitor for limiting current provided to the bootstrap capacitor and for regulating a voltage of the bootstrap capacitor.*

The claims on appeal stand rejected as follows:

(1) claims 1–3 and 9–15 under 35 U.S.C. § 103(a) as unpatentable over Applicants' Admitted Prior Art in view of Kularatna;[5]

(2) claims 1–3 and 9–15 under 35 U.S.C. § 103(a) as unpatentable over Chen[6] in view of Applicants' Admitted Prior Art;

(3) claims 4–8 under 35 U.S.C. § 103(a) as unpatentable over Applicants' Admitted Prior Art in view of Kularatna and further in view of Vasquez;[7] and

(4) claims 4–8 under 35 U.S.C. § 103(a) as unpatentable over Chen

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[4] Appeal Br., Claims Appendix 10.
[5] Kularatna et al., US 7,907,430 B2, issued Mar. 15, 2011 ("Kularatna").
[6] Chen, US 8,138,731 B2, issued Mar. 20, 2012 ("Chen").
[7] Vasquez et al., US 2007/0114981 A1, published May 24, 2007 ("Vasquez").

in view of Applicants' Admitted Prior Art and further in view of Vasquez.

B. DISCUSSION

Rejection over Applicants' Admitted Prior Art and Kularatna

Claims 1–3 and 9–15 are rejected under 35 U.S.C. § 103(a) as unpatentable over Applicants' Admitted Prior Art in view of Kularatna. We select claim 1 as representative for discussing the issues on appeal.

The Examiner finds Applicants' Admitted Prior Art, particularly Figure 1 of Appellants' disclosure, discloses a low side switch 20, a high side switch 22, a bootstrap capacitor 26, and a driver 24 but does not disclose an energy storage capacitor and voltage regulator. Final Act. 3. The Examiner finds Kularatna discloses an energy storage capacitor 54 and a voltage regulator 50 for regulating an output voltage. *Id.* The Examiner concludes that it would have been obvious to provide the energy storage capacitor and voltage regulator of Kularatna in the arrangement of Applicants' Admitted Prior Art "in order to provide a stable and accurate voltage to the driver in Applicants' admitted prior art Fig. 1." *Id.*

Appellants argue that "the claims include an energy storage portion and a voltage regulator ***in parallel with the bootstrap capacitor***." Appeal Br. 4. Appellants argue the Examiner does not show a voltage regulator in parallel with a bootstrap capacitor as claimed because the Examiner "admits that Appellant's Figure 1 does not show it and the Kularatna reference does not have such a voltage regulator, either." Appeal Br. 5.

In response, the Examiner finds that

> voltage regulator (50) is connected in parallel to capacitor (54) . . . . [T]he regulator can be a shunt (parallel) or series regulator. Shunt regulator is connected in parallel across a load

> (60) and the capacitor (54) and when combined with Appellant's figure 1, the load in Appellant's figure 1…will be capacitor (26) [i.e., bootstrap capacitor (26)].

Ans. 6–7.

Appellants argue that "the Examiner's position that the load 60 in the *Kularatna* reference corresponds to the bootstrap capacitor 26 of Appellant's Figure 1 demonstrates how strained the Examiner's position is." Reply Br. 2. Appellants argue:

> The load 60 in the *Kularatna* reference is not a bootstrap capacitor that supplies power to a driver that controls operation of a switch.[8] The capacitor 54 in the *Kularatna* reference is not a bootstrap capacitor that supplies power to a driver that controls operation of a switch.[9] Therefore, it does not matter whether the series LDO voltage regulator 50 of the *Kularatna* reference is in a series or parallel relationship with the capacitor 54 or the load 60 of that reference. There still is nothing to teach or suggest a voltage regulator situated in relationship with a bootstrap capacitor as those elements are included in Appellant's claims.

Reply Br. 2.

Appellants' arguments are persuasive of reversible error. As argued by Appellants, the Examiner has engaged in impermissible hindsight in the rejection of claim 1. "While the Supreme Court made clear that a mechanical application of the teaching-suggestion-motivation test, requiring an explicit teaching in the prior art, is inappropriate, '[w]e must still be careful not to

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[8] Appellants' Figure 1 identifies load 12, and Appellants' Figure 2 identifies load 42.

[9] In the rejection on appeal, the Examiner does not find that energy storage capacitor 54 corresponds to the claimed bootstrap capacitor. Rather, the Examiner finds energy storage capacitor 54 corresponds to the claimed energy storage portion. *See* Ans. 3–4 (referring to energy storage portion 60 in Appellants' Figure 2 as "energy storage capacitor (60)").

allow hindsight reconstruction of references to reach the claimed invention without any explanation as to how or why the references would be combined to produce the claimed invention.'" *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1368 (Fed. Cir. 2012) (citing *Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 n. 3 (Fed. Cir. 2008)).

The Examiner also finds Kularatna discloses voltage regulators as being "well-known in the electrical engineering field" and used to "convert and condition the battery output or mains current to a particular voltage level." Ans. 8. However, the Examiner's finding does not explain why one of ordinary skill in the art would have arranged such devices in a parallel relationship with a bootstrap capacitor, as recited in claim 1. *See* Reply Br. 2–3.

Based on the foregoing, the § 103(a) rejection of independent claim 1 and dependent claims 2, 3, 9, and 10 based on the combination of Applicants' Admitted Prior Art and Kularatna is not sustained.

Independent claim 11 recites a method that includes "providing an energy storage *in parallel with the bootstrap capacitor*" and "regulating the voltage of the bootstrap capacitor using a linear regulator *in parallel with the bootstrap capacitor*." Appeal Br., Claims Appendix 11 (emphasis added). The Examiner relies on the same factual findings and legal conclusions in the rejection of claims 1 and 11. *See* Final Act. 3. Thus, for the reasons discussed above with regard to claim 1, we do not sustain the rejection of claim 11 and dependent claims 12–15 over the Admitted Prior Art in view of Kularatna.

Rejection of claims 4–8 over Applicants' Admitted Prior Art, Kularatna, and Vasquez

Claims 4–8 are rejected under 35 U.S.C. § 103(a) as unpatentable over Applicants' Admitted Prior Art in view of Kularatna and further in view of Vasquez. Claims 4–8 depend from claim 1. The Examiner does not rely on Vasquez to cure the deficiencies in the rejection of claim 1 identified above. *See* Final Act. 5–6. Therefore, the § 103(a) rejection of claims 4–8 based on the combination of Applicants' Admitted Prior Art, Kularatna, and Vasquez is not sustained for the same reasons we do not sustain the rejection of claim 1.

Rejection over Chen and Applicants' Admitted Prior Art

Claims 1–3 and 9–15 are rejected under 35 U.S.C. § 103(a) as unpatentable over Chen in view of Applicants' Admitted Prior Art. We select claim 1 as representative for discussing the issues on appeal.

The Examiner finds "Chen discloses the claimed invention except for [a] driver with an energy storage capacitor. Applicant's admitted prior art Fig. 1 teach the use of *a driver with an energy storage capacitor* for a power supply." Final Act. 3 (emphasis added). We understand the "energy storage capacitor" referred to by the Examiner to be a bootstrap capacitor, not an energy storage capacitor as found by the Examiner, because the only capacitor identified in Applicants' Admitted Prior Art Figure 1 is "bootstrap capacitor 26" which "powers the upper gate driver 24." Spec. ¶ 2.

The Examiner concludes that it would have been obvious to one of

ordinary skill in the art "to provide a driver [in Chen] to control the switches as taught by Applicant's admitted prior art in order to turn on and off the switches." Final Act. 4. The Examiner finds the modified Chen power supply 200 comprises:

> a low side switch (S2); a high side switch (S3); an energy storage (C_{BUS}) portion in parallel with the bootstrap capacitor [26]; and a voltage regulator (202) in parallel with the bootstrap capacitor [26]… for limiting current provided to the bootstrap capacitor and for regulating a voltage of the bootstrap capacitor.

Final Act. 4.

Appellants argue "[t]here is nothing in the Chen reference that suggests that the regulator 202 is in parallel with the bootstrap capacitor for limiting current provided to the bootstrap capacitor and for regulating a voltage of the bootstrap capacitor as suggested by the Examiner." Appeal Br. 7. Rather, Appellants argue that "the regulator 202 steps up the input voltage to the bus voltage." Appeal Br. 7 (citing Chen, col. 4, ll. 54–56).

In response, the Examiner finds that Chen Figure 2A shows "the voltage regulator (202) is connected in parallel to the [energy storage] capacitor (C_{BUS})." Ans. 10. However, Appellants argue that "capacitor [C_{BUS}] . . . is not a bootstrap capacitor that supplies power to a driver that controls operation of a switch [as recited in claim 1]." Reply Br. 3.

On this record, the Examiner has failed to show, in the first instance, that one of ordinary skill in the art, following the teachings of Chen and Applicants' Admitted Prior Art Figure 1, would have modified Chen's power supply 200 with bootstrap capacitor 26 (in Applicants' Admitted Prior Art Figure 1) as recited in claim 1, i.e., wherein Chen's regulator 202 is "in parallel with the bootstrap capacitor [26] for limiting current provided to the bootstrap capacitor and for regulating a voltage of the bootstrap

capacitor." Appeal Br., Claims Appendix 10. For that reason, the § 103(a) of independent claim 1 and dependent claims 2, 3, 9, and 10 based on the combination of Chen and Applicants' Admitted Prior Art is not sustained. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (examiner bears the initial burden of presenting a prima facie case of unpatentability).

Independent claim 11 recites a method that includes "providing an energy storage *in parallel with the bootstrap capacitor*" and "regulating the voltage of the bootstrap capacitor using a linear regulator *in parallel with the bootstrap capacitor*." Appeal Br., Claims Appendix 11 (emphasis added). The Examiner relies on the same factual findings and legal conclusions in the rejection of claims 1 and 11. *See* Final Act. 3–4. Thus, for the reasons discussed above with regard to claim 1, we do not sustain the rejection of claim 11 and dependent claims 12–15 over Chen in view of the Admitted Prior Art.

Rejection of claims 4–8 over Chen, Applicants' Admitted Prior Art, and Vasquez

Claims 4–8 are rejected under 35 U.S.C. § 103(a) as unpatentable over Chen in view of Applicants' Admitted Prior Art and further in view of Vasquez. Claims 4–8 depend from claim 1. The Examiner does not rely on Vasquez to cure the deficiencies in the rejection of claim 1 identified above. *See* Final Act. 6. Therefore, the § 103(a) rejection of claims 4–8 based on the combination of Chen, Applicants' Admitted Prior Art, and Vasquez is not sustained for the same reasons we do not sustain the rejection of claim 1.

C. DECISION

The decision of the Examiner is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1).

REVERSED